Crafting a Web-based, Non-Violent, Real-Time Strategy Game

Brian Winn and Jason Tye
Michigan State University GEL Lab (Games for Entertainment and Learning) and Department of Telecommunication, Information Studies, and Media

Abstract

This paper explores the process of design that was undertaken in the development of a web-based real-time strategy (RTS) game. Through analysis and evaluation of existing RTS games, we outline the features of this game genre. Utilizing secondary research, we explore the technical issues and design constraints involved in the delivery of a web-based game. Looking at the technical constraints and the game features, we outline the design of a game, called *Mudcraft*. *Mudcraft* is a web-based, real-time strategy (RTS) game that challenges you to work with Mother Nature as you build a strong mud community while foregoing the violence associated with most RTS games. *Mudcraft* is a lighthearted game designed to be enjoyable to male and female players of all ages. Results from a formal playtest of the first playable prototype of the game are presented, demonstrating that the design goal was achieved. We conclude by outlining the game design process that combines upfront secondary research, creative design and development, rapid prototyping, and formal and informal playtesting.

Introduction

In spring of 2004, a team of game designers and developers developed a real-time strategy (RTS) game for the web. While we wanted the game to be true to the RTS genre, we also wanted to design a game that was appealing to the casual, mixed-gender audience that plays web-based games. Delivery through the web presented several technical challenges. The development of the resulting game, took just over a year to complete. This paper explores the *Mudcraft* design process including upfront secondary research, creative game design and development, and formal and informal playtesting.

Defining real-time strategy games

Real-Time strategy games are the descendents of traditional strategic board games, such as *Risk* and *Axis & Allies*. These board games, involving many pieces, rules, large playing fields and rolls of the dice, can be very time consuming and complicated to manage for a group of human players, but can be handled easily by a computer. In fact, computers are so good at managing the game's rules and data that it has become possible for game events to happen seemingly simultaneously. Players no longer have unlimited time to plan their moves in advance. There is no 'turn'. Time becomes a factor in the formation of game strategy. The player who uses their time better has an edge. This is real-time strategy.

While there have been many games with elements that are now common among RTS games, Westwood's *Dune II* is widely referred to as the first real-time strategy game. Released in 1992, and based on the novel by Frank Herbert, *Dune II's* designer believed that strategy games would be "out of control fun" (Geryk, B. 2002) if the real-time aspects of other arcade-style games could be combined with the resource management of turn-based strategy games.

Since the first RTS, many more real-time strategy games have emerged. Westwood went on to develop the *Command & Conquer* series of games, Blizzard Entertainment developed the *Warcraft* and *Starcraft* series of games, and Ensemble Studios developed the *Age of Empires* series. Today, RTS is a cornerstone genre of the game industry. While *Dune II* employed several features that became the roots of modern RTS game, the genre has grown in scope and complexity, while at the same time solidifying several design patterns common in the genre.

Rollings and Adams define three common themes found in RTS games: conquest, exploration, and trade. Conquest centered RTS games are the most reminiscent of traditional turn based strategy games that

dealt mostly with players trying to defeat one another's armies. The focus of a conquest RTS game is to generate an offensive force and defeat your opponent, often by destroying all of his or her means of production through military combat. The primary goal of an exploration focused RTS is typically to explore an unknown world, while expanding a civilization. In trade-oriented games, the player focuses on expanding the economy of an entity such as a civilization or business in order to increase its value. While most RTS games are based on a single themes, many include elements of all three (Rollings, A. and Adams, E. 2003).

No mater the theme, all RTS games involve some form of resource management and game economy. The currency in *Dune II* was spice, which was gathered and used to purchase new buildings and new units. In modern games a player may be required to gather X amounts of resource A, B, and sometimes C, or convert A and B into C and D before they are able to produce a certain unit. In general, the more powerful a unit, the more resources it will take to create.

The aesthetics or setting of a game is also a vital characteristic. Two games with the same underlying mechanics can feel completely different based on their different aesthetic. For example, both *Starcraft* and *Warcraft II* have very similar game mechanics, but vastly different settings (alien sci-fi vs. medieval fantasy.) Different aesthetics appeal more or less to different players. The three most common aesthetics for RTS games are a science fiction future, a mythical fantasy world or historical past (Rollings, A. and Adams, E. 2003).

Over time, the interface, including both input (controls) and output (display), for most RTS games have become fairly standardized. Most RTS games have three basic windows. The first is the game window, which is the primary view of the game world. It is also the primary area the player interacts with the units in the game. This window is almost exclusively presented in a top-down or isometric view in most RTS games. The second window, the status window, allows the user to view addition information and see additional actions that are associated with the selected unit, building, or item. The third common window is the 'mini-map', a small representation of the entire playing field or map.

While the video game console market has over shadowed the personal computer game market in recent years, even today's RTS games are almost exclusively built for personal computers. This is mostly due to the input controls required for this type of game. RTS games are designed around the robust input flexibility of a keyboard and mouse. That is, RTS games often require the user to precisely select units using a pointer; an action generally accomplished faster with a mouse then a game pad.

Since most of the popular real-time strategy games, including *Warcraft*, *Starcraft*, *Command and Conquer*, and *Age of Empire* series of games, involve fairly in-depth, complex game mechanics focused primarily on themes of conquest, set in science fiction futuristic or mythical fantasy worlds, the genre has traditionally appealed more to the core gamer audience, which tend to be male dominated.

Secondary research

Web-based games can be viewed as a separate class from standard PC games. A major distinction is that web-based games utilize the Internet for game delivery rather than a CD or DVD drive. Typically the user will navigate to a website containing a link to the game application. After clicking on the link the game application is loaded into the web browser's cache, a temporary place in the computer's memory or hard drive, and displayed in the web browser's window. Like games installed in the traditional manner, often the essential parts of the program that are downloaded and run, while non-essential data is read in later. But, unlike traditional games this data is read from a server rather than a disk. One obvious advantage of web-based delivery is that when the game developers update their game, the players will automatically get the latest version the next time they access the server.

Over the past decade, due to developments in communication technology and software, such as high-speed Internet access in homes and software development environments such as Java, DHTML, Flash and Shockwave, the Internet has turned into a new medium for the development of games. Web-based

games utilize the same keyboard and mouse interface that PC desktop games use, but have additional technological and design constraints, which set them apart from standard PC games.

Many of the top-selling and top-rated PC games have come from the RTS genre. But, the position of RTS games in the traditional PC gaming market and the web-based gaming market are very different. While RTS games make up a substantial portion of the available PC games in retail stores, they are all but nonexistent on the web. To better illustrate this, we conducted a survey. On April 6, 2004, we visited three local venues for purchasing PC games, *Best Buy*, *GameStop,* and *EB Games*. We counted the number of unique game titles available for PC that classified, on the packaging, that they were RTS games. On the same, day we visited three websites for online gaming and counted the number of games that could be classified as real-time strategy. Tables 1 and 2 show that while RTS games made 9 to 10 percent of the PC games available in the retail stores, they are almost unrepresented in the web-based venues.

Name of store	Number of unique game titles	Number of RTS	Percentage
Best Buy	310	29	9.4%
GameStop	536	56	10.4%
EB Games	283	26	9.2%

Table 1: RTS games available in retail stores

Name of site	Number of games	Number of RTS	Percentage
Yahoo games at: Games.yahoo.com	84	0	0%
Electronic Arts Pogo games at: Pogo.com	58	0	0%
Shockwave games at: Shockwave.com	201	1	.5%

Table 2: RTS games available online

The complexity of web-based games

Current web-based games are often very simple, easy to learn and play games. Most web-based games have few rules for the user to learn before they are ready to play. For example, in April 2004, we examined games available on *Yahoo Games* website. There are six categories of games available on the site, and we looked at the first two games of each category. Of the 12 games, only one had more then a single screen of instructions. None of the online games that we looked at had any form of persistent story. Most of the games consisted of a single playing area. In some cases, the games were made up of multiple levels with each level being short in duration and often consisting of the same playing area.

The relative simplicity of web-based games makes them very easy to pick up, enjoy and walk away from without having to commit a lot of time into learning and playing the game. The games often cater to players who want to pass some time during lunch or short breaks. However, the simplicity of web-based games is not solely due to the desires of the online game players. It is partly due to the technical limitations of the delivery medium.

Technical limitations of web-based games

Due to their dependence on the Internet, web-based games share many of the same technical issues and dependencies of other online services. Web-based games require a web server, connected to the Internet, on which the game file is stored and accessed. Depending on the type and purpose of the game, other services may also be required. Some Network Service Provider will provide particular services for game hosting. “In the case of gaming, this organization might supply caching, security, authorization, copy protection, etc. host a gaming service or resell a gaming service provided by some other organization.” (Bahlmann, B. 2002).

The amount of time it takes to download the game is one of the greatest limitations of a web-based delivery. This is influenced by several different factors such as throughput of the server, the server's connection speed, speed of the Internet and the users connection speed (Nielson, J. 2004). Of all the factors, the connection speed of the user can be the most significant, as it is usually the slowest part in the chain. Since users have come to expect relatively short download times, web-based games are traditionally very simple. As of January 2004, broadband penetration (cable modem or DSL) was reported at 38% (Nielson, J. 2004*).* In general, with an average broadband connection of 600KB/sec, we could expect to deliver about 4.5 megabytes of data in less then a minute. With such limitations on file size, the quality and amount of features such as sound, graphics and animations are greatly decreased in web-based games as compared to CD or DVD-based games.

Other key factors that can affect the design and development of web-based games are characteristics of the target user's computer, such as browser, operating system, and computer power. These factors can greatly affect, or sometimes hinder proper playback of a web-based application.

The audience for web-based games

Another way in which web-based games differ from desktop games is in the make-up of their audience. Most web-based games are designed to be short, easy to learn, and not require a large time commitment from the user. This type of game primary caters to casual gamers.

Further, the breakdown of male and female players is very different for desktop and web-based games. The desktop game market is predominantly male-oriented, and this is reflected in many of the types of games, which are often conflict or destruction-based. The area of web-based games is very different. According to Nielsen/NetRatings, 41% of people who frequent web-based game sites are women (Fattah, H. and Paul, P. 2002), with women over 40 as the most active players of online games averaging 9.1 hours a week (Morris, C. 2004). This gender shift is reflected in the types of web-based games, which are often puzzle, card, or problem solving type games. Stereotypically, these are often seen as the types of games women enjoy.

A recent study by Heeter looked at issues of gender in game design (Heeter, Egidio, and Mishra, 2004). The study involved separate groups of boys and girls from the 5th and 8th grade designing a space game for children of the same age. The preliminary results of the study found that the games designed by the female groups did not involve killing or beating an evil entity, but rather the solving of a problem. The study also showed that while the games designed by both the male and female groups involved elements of danger, the threatening circumstances in the games from the female groups tended to be more light-hearted and silly. If we apply these findings to a real-time strategy game, we may be able to develop a game that women also find appealing.

Creative design and development

To create a web-based RTS game with broad appeal based on the secondary research presented above, we knew we needed to design a game such that:

1) The theme focused primarily on exploration and trading, rather than conquest and violent combat.
2) The aesthetics are lighthearted and humorous rather than rugged and abrasive
3) The interface and game mechanics are simply and easy to learn
4) The duration of play per level is greatly reduced from that of common commercial RTS games
5) The game is built on technology for and within technical constraints conducive to web delivery.

Game mechanics, dynamics, and aesthetics

Mudcraft takes place in a whimsical, grassy backyard. A light from above shines down on a mud pit and mud life emerges. At the start of the game, the player has two mud people. The player must direct the mud people to gather dirt and water from around the world and bring it back to the mud pit. Thus, creating more mud people, who in turn can gather additional resources. Each level in *Mudcraft* has its own goals and objectives, but in general the object of the game is to grow a Mud community.

Figure 1 – Mudcraft game screen

In the world of *Mudcraft*, there are a number of forces working against the player. For example, at various times during the game, rain or intense sunlight may come, and any exposed mud person will melt or dry, respectively. In order to avoid this, the player will to have to direct their mud people outside of harms way, or develop huts in which the mud people can escape the weather. If a mud person does melt or dry, the player can direct another mud person to revive them by dropping dirt on them or spraying water on them, respectively.

There are various creatures in the world other than the mud people. While none are a direct enemy of the mud people, they can cause you quite a bit of grief. For example, the frogs are attracted to mud people and, thinking the mud people are food, will flick them with their tongues. This causes a mud person to drop anything they were carrying and forget what they were doing.

While the player does not have a direct presence in the game, they control the fate of their mud people. Should something happen and all the mud people under the player's control are all immobilized, the player loses. As long as one mud person is active, play continues.

The basic resources in the game are dirt and water. These are used to create the mud people, as well as revive them from various immobilized states. Dirt is obtained from holes in the ground, while water is obtained from small ponds.

Mud people themselves are the material to create structures in the game, for example: to build a hut the player selects a mud person and directs them to a location and tells them to start a hut, that mud person then transforms into the first level of a hut. The player then directs two additional mud people to become the second level and finally the roof of the hut. By using the mud people in this way, the mud people themselves are an essential element of the games economy.

In later levels, sticks are introduced as another resource. Mud people can pick up sticks, which give them additional "magical" powers, such as the ability to call rain or the sun, create fire, or scare creatures away.

Unlike most RTS games, there are no military units in *Mudcraft* or themes of conquest. While the player cannot perform direct violent acts in the game, their mud people can be harmed. For example, mud

people melt when rained on or dry up when hit by intense sun. These immobilized mud people can be revived. However, if they are not revived before another storm catches them, they will melt away or crumble to the ground (i.e., they die). While the game is essentially non-violent, we felt and playtesting confirmed that there needed to be this element of life and death in the game. That is, there needed to be "something on the line" to create the dynamics of a compelling RTS game. After all, a RTS is at its core a game of resource management. If there were no consequences for playing poorly, it would not be much of game.

The overall story, artwork, and sound in the game are designed to be humorous and have broad appeal. The graphics and sound are comical and cartoon-like. The appearance of the mud people is gender-neutral and the gender of the voices are distributed evenly between male and female. The limited game story is very lighthearted and stresses a positive, but mildly stated message about living in harmony with Mother Nature.

Interface

In order to make *Mudcraft* familiar to RTS players, we included the common game and mini-map windows found in most RTS games (refer to Figure 1), but eliminated the status window, replacing it with contextual information that appears in the game window. This was done to simplify the interface and keep the players focus on the game window.

The mouse and keyboard control system also attempts to parallel RTS standards with a few innovations designed to help non-RTS players. Selection of units in the game uses the point and left-click or left-click-and-drag standards of the desktop graphical user interface. After selecting a unit or units you can point and right-click on a location on the terrain to perform an action. The action taken is context-sensitive based on the item clicked on and the current state of the game. For example, the player may select a mud person by left-clicking on him or her, then tell the mud person to gather water by right-clicking on a pond. This left-click and right-click sequence is standard in many RTS games. The game was designed so most interactions simply require the left-click and right-click sequence. However, if the user holds the right mouse button down, a context sensitive popup menu appears that presents additional context-sensitive options the selected units can perform.

For more advanced players, *Mudcraft* also has keyboard shortcuts ("hot keys") similar to those found in commercial RTS games. Users can speed up interactions with the game by utilizing these keys.

Mudcraft uses sound to help the user and alert them to different game events. The characters in the game give audio responses when selected or given a command, and when something happens. This helps let the player know that a command was received, draws attention to an unexpected event or directs the player's attention to something that takes place outside of what is visible in the game window.

Technical Design

There are several software technologies that are available for online game development, such as Flash, Java, DHTML and Shockwave. While each of these technologies has strengths and weaknesses, we chose to develop *Mudcraft* with Macromedia Director for Shockwave delivery. Shockwave has flexibility in the types of media it supports, includes a robust 2D graphics engine that can handle over 100 sprites on-screen at once at a reasonable level of performance, and has a powerful, mature scripting language. Further, the Shockwave player is freely available for users to download and there is no licensing required for game deployment. Developing in Shockwave also allowed us the flexibility to deliver the game in multiple ways, such as in the browser or downloadable (as an application), as well for multiple platforms, including Windows and Macintosh.

The biggest technical challenges that we faced for web delivery was playback performance and download performance. While the game itself was developed in Director, the vector animation tool Flash was used in the creation of almost all of the artwork. Although vector artwork typically is very small in file size, it can be very processor intensive for the computer to render. This affects playback performance, as more and

more elements are rendered on-screen. In order to reduce the processing load of the games graphics, pre-rendered (rasterized) frame-by-frame bitmap images of the vector artwork was used for most character motion in the game. Bitmap animation reduces processor load because the computer needs to only replace one bitmap graphic with another in sequence, as opposed to vector animation, in which the computer must calculate the mathematical equations needed to render the vector image. Although bitmap animation can lead to an overall larger file size, there are ways to manage its impact. JPEG compression was used to greatly reduce the images' file size. Further, the number of frames of animation in the game was reduced to the number need to create the illusion of character motion. Vector graphics were used in areas of the game that either were less processor intensive, such as the animated introduction or cut scenes, or were the graphics were static (non-animated) such as the interface elements outside of the game window. The use of vector images further reduced the overall game file size, thereby reducing download time.

Sound is another "heavy" media element for online delivery. Similar to graphics, we balanced the amount of sound used in the game to provide a lush, aurally interesting experience without going overboard. While unique music was used on each level, it was kept to approximately 30 seconds and composed to seamlessly loop while not sounding overly repetitive. Sound effects were kept to a minimum and generally were used to signify important gameplay related events, such as an approaching storm. Most of the sound budget was spent on the actual mud people's dialog, as we knew this would provide interest, humor, character, and emotion to the game. For most actions we recorded multiple response phrases for both male and female characters. Actions that are more frequently taken by the player were allocate more variety in the number of phrases. Overall we limited ourselves to two to five total phrases per action for each gender. All sound was compressed for web delivery using Director's internal Shockwave audio compression technique, which is similar to MP3 compression.

To further speed the startup time for web delivery, we explored several methods to break the game into logical chunks and only download each chunk when needed by the player. In theory, this would allow us to get the game up and running quickly and then download later levels as the player progressed through the game. Unfortunately many of the game assets did not lend themselves well to this chunking method. Further, it fragmented the project across many files and made development and debugging more difficult. Since we already reduced the total game size to ~4.5 MB, our target file size, using the techniques documented above, we ultimately decided against this technique in the final game.

Formal playtesting

After designing and implementing the first playable prototype, we conducted a formal playtest to evaluate the game's design and gather information about how the game may be improved. For the evaluation, we recruited eight individuals, four males and four females, to play the prototype for ten minutes while being observed.

All four male participants had played RTS games, and none of the female participants had done so. All four male participants had played web-based games, and only one of the four females had done so. Overall the females were younger. Female age ranged from 22 to 32 with an average of 25, while male ages ranged from 28 to 36 with an average of 32 (see Table 3.)

Pseudonym	Gender	Age	RTS Experience	Web-Game Experience
Sarah	Female	32	Never played an RTS game	Has played
Jessica	Female	25	Never played RTS game	Does not play
Mandy	Female	22	Never played RTS game	Does not play
Julie	Female	22	Never played RTS game	Does not play
Ben	Male	28	Has played RTS games	Has played
Kevin	Male	34	Has played RTS games	Has played
Andrew	Male	29	Has played RTS games	Has played
Tim	Male	36	Has played RTS games	Has played

Table 3: Subject profiles

During the testing, the players were observed and asked to think aloud and voice any difficulties they were having. Five of the eight subjects laughed or giggled while playing, including all four female subjects and one male subjects. Three of the four female subjects used the in-game instructions repeatedly, while none of the males did. All of subjects showed some form of initial confusion when they first began playing the game. The confusion seemed to last longer for those who had never played a real-time strategy game (i.e., primarily the female subjects). Inexperienced (female) players were more likely to look at in game instructions (no experienced-male players did). Experienced (male) players more often used hot keys and recognized the mini-map.

Initial confusion aside, all the subjects were able to understand and enjoy the game after ten minutes of play. All the subjects, except for Sarah, asked to continue to play past the allotted time. And all the subjects, except for Sarah, asked if and where the game would be available for further play. Since the testing, all of the test subjects have contacted us with addition positive feedback about the game. Each of subjects seemed very impressed with the game and enjoyed playing it. Table 4 contains a summary of the observations from the playtesting.

	Tim	Kevin	Ben	Andrew	male	Mandy	Jessica	Sarah	Julie	female
Giggle/laugh	N	N	Y	N	1	Y	Y	Y	Y	4
Read Instructions	Y	Y	Y	Y	4	Y	N	Y	Y	3
Looked at in-game instructions	N	N	N	N	0	Y	Y	N	Y	3
Understood how to use popup menu based on written instructions	N	N	N	Y	1	N	N	N	N	0
Used hot keys	Y	Y	Y	Y	4	Y	N	N	Y	2
Had trouble at first	Y	Y	Y	N	3	Y	Y	Y	Y	4
Understood what to do to achieve mission goal	N	Y	N	Y	2	Y	N	N	N	1
Got the hang of it after 10 minutes of play	Y	Y	Y	Y	4	Y	Y	Y	Y	4
Asked for help	Y	Y	Y	Y	4	Y	Y	Y	Y	4
Misidentified dirt hole	Y	Y	Y	N	3	N	N	N	Y	1
Misidentified water hole	N	N	Y	N	1	N	N	N	N	0
Recognize mini-map	Y	Y	N	Y	3	Y	N	N	N	1
Enjoyed the game	Y	Y	Y	Y	4	Y	Y	Y	Y	4

Table 4: User observation synthesis

After playing the game, subjects were asked 17 questions about their impressions of the game. All eight subjects enjoyed the game. All would like to play a future version, know others who would like to play the game and would like to play other games like this online. They all liked the concept and all found it

engaging. Sarah remarked it might be little too engaging because “I could see myself wasting a whole lot of time (playing the game)”.

The players were very positive about the look of the game and its sound effects and music. Males tended to comment that it looked “cool” or “neat” or “funny,” while females called it “cute” as well as “cool” and “funny.” Although Sarah disliked the music, saying it was “too twangy,” Mandy liked it so much she wanted to obtain the sound track. Kevin noted that sometimes the sounds got repetitive, but again, overall, people strongly liked the music and sound effects.

The participants were very positive about the game but suggesting that the instructions were a bit lacking. Two of the females said the difficulty was a little hard at first. The other two females said it was not too complicated. Two of the males said it was too complicated at first, and the other two males thought it was fine. This same pattern of responses occurred when people were asked whether it was easy to learn. Three respondents said the first level was too hard for a first level. Several mentioned it also gets harder when you have more mud people to manage.

As far as suggestions for improvements, all of the players suggested more instructions or documentation. Two suggested a tutorial of some kind. Initially the instructions were designed to be brief and only cover the basic mechanics, in order to resemble current web-based games. After testing, the amount of instructions available was increased, both on the games web site and inside the game itself. Further, the first level was redesigned to be a fairly easy, tutorial level that walked the player step-by-step through the basics of how to play the game.

Conclusion

As development has continued, the game has been made available online at www.mudcraft.com, allowing thousands of players to experience *Mudcraft* and provide us with feedback, essentially becoming informal playtesters. This has greatly helped us improve the games interface, balance the complexity of play, and provide polish to the game, while reiterating the results found in our formal playtest that our design accomplishes its goals of creating a non-violent, web-based real-time strategy game that is appealing to a broad audience.

Overall, this project presents an approach to game design that combines upfront secondary research, creative design and development, rapid prototyping, and formal and informal playtesting. After the successful development and testing of *Mudcraft* we have shown that it is entirely possible to create a real-time strategy game for web-based delivery. Furthermore, by taking into consideration the disposition of the audience and looking at the design of popular web-based games, as well as the compelling features of current RTS games, it is possible to design a web-based RTS game that is appealing to a wider audience than the current, male dominated audience.

A formal, quantitative study of game play patterns and preferences among a large sample of Mudcraft players would confirm our playtest findings and extend understanding of RTS play styles and gender.

We hope that *Mudcraft* also illustrates that it is possible to create games with greater quality and complexity than those generally found on the web today and that the Internet is a viable delivery medium for robust, independent games which explore new aspects of current game genres. This opens the door not only for more web-based real-time strategy games, but games from other genres that are also underrepresented on the Internet. As broadband availability and use becomes more prevalent, and as Internet access speeds increase, individuals of all ages (and genders) will look for more compelling games to play online. We believe, using an approach similar to that outlined here, it is possible for game designers to deliver those gaming experiences.

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